



# Special Opportunities for Highly Sampled Areas

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# Introduction

## Context

- Some HyspIRI process questions can be addressed with samples, in lieu of full global maps.
- Some VSWIR questions will be difficult to answer without some information at intervals < 19 days.
- Some areas may have repeat TIR data over short intervals (e.g., day-night pairs).

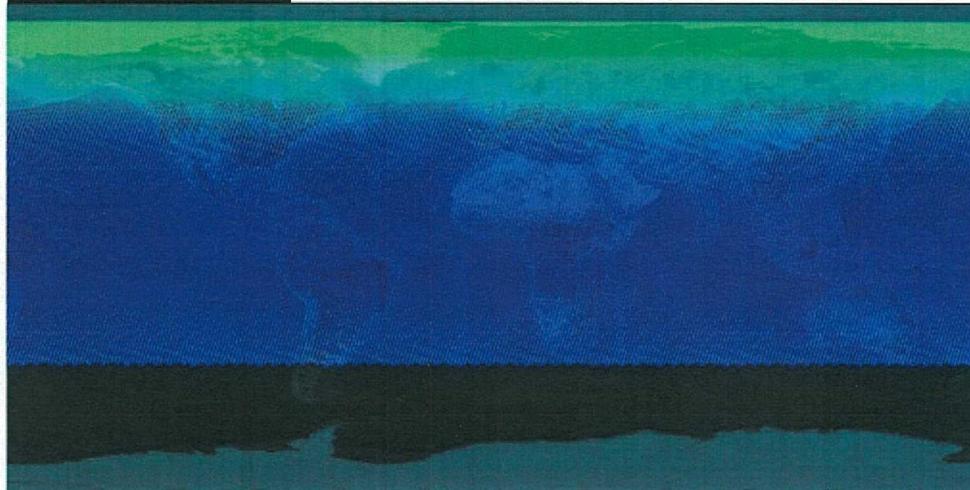
## Outline

- VSWIR Coverage simulations
  - Global coverage grids
  - Example FLUXNET tower sites
- TIR coverage simulations
  - Global coverage grids
  - Example FLUXNET tower sites
- Minimum TIR revisit intervals and opportunities to measure diurnal variation.

# VSWIR coverage frequency varies seasonally



VSWIR: July 1-20, 2016

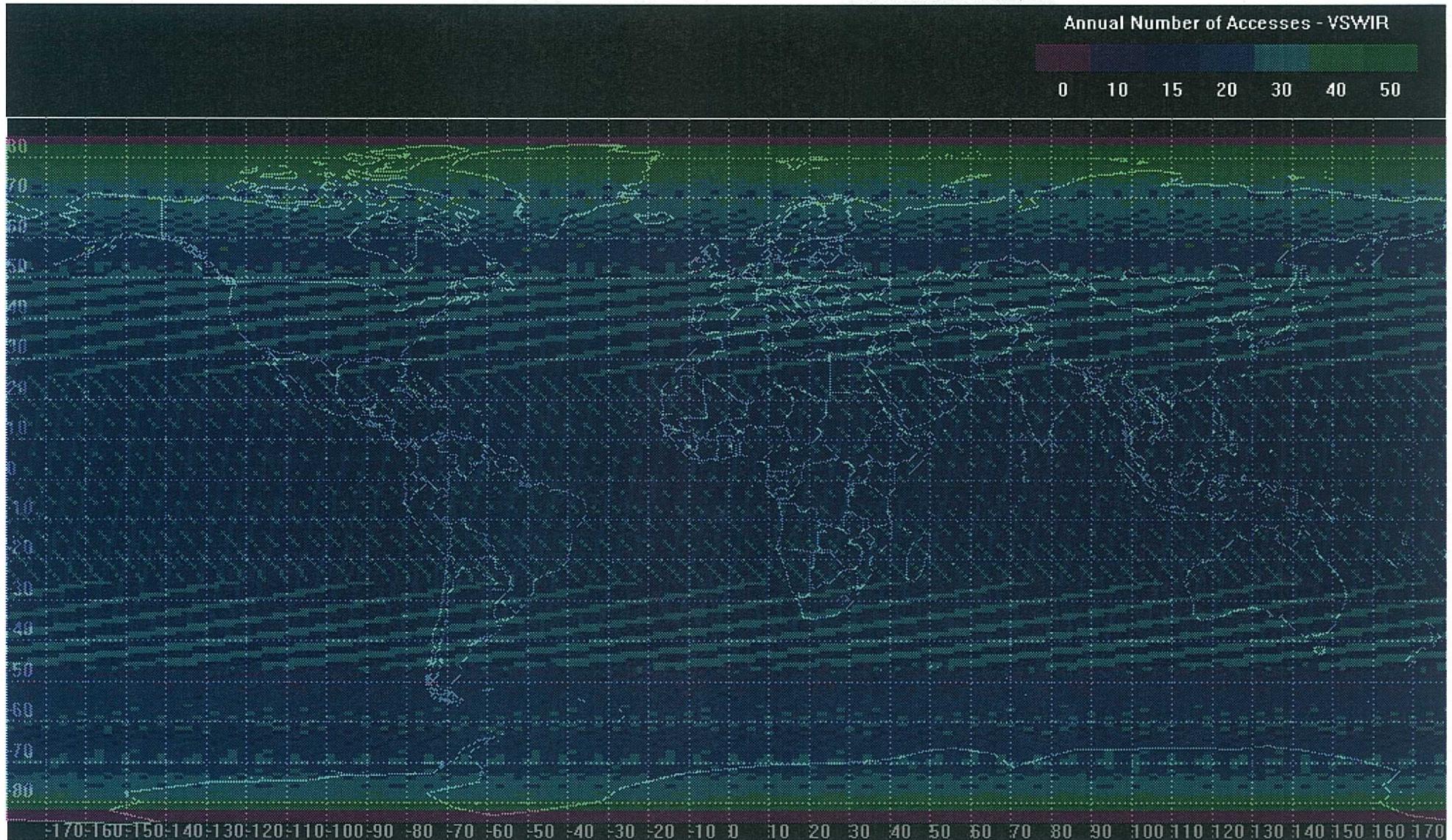


VSWIR coverage is limited by constraint: minimum 20 deg. Sun elevation angle.

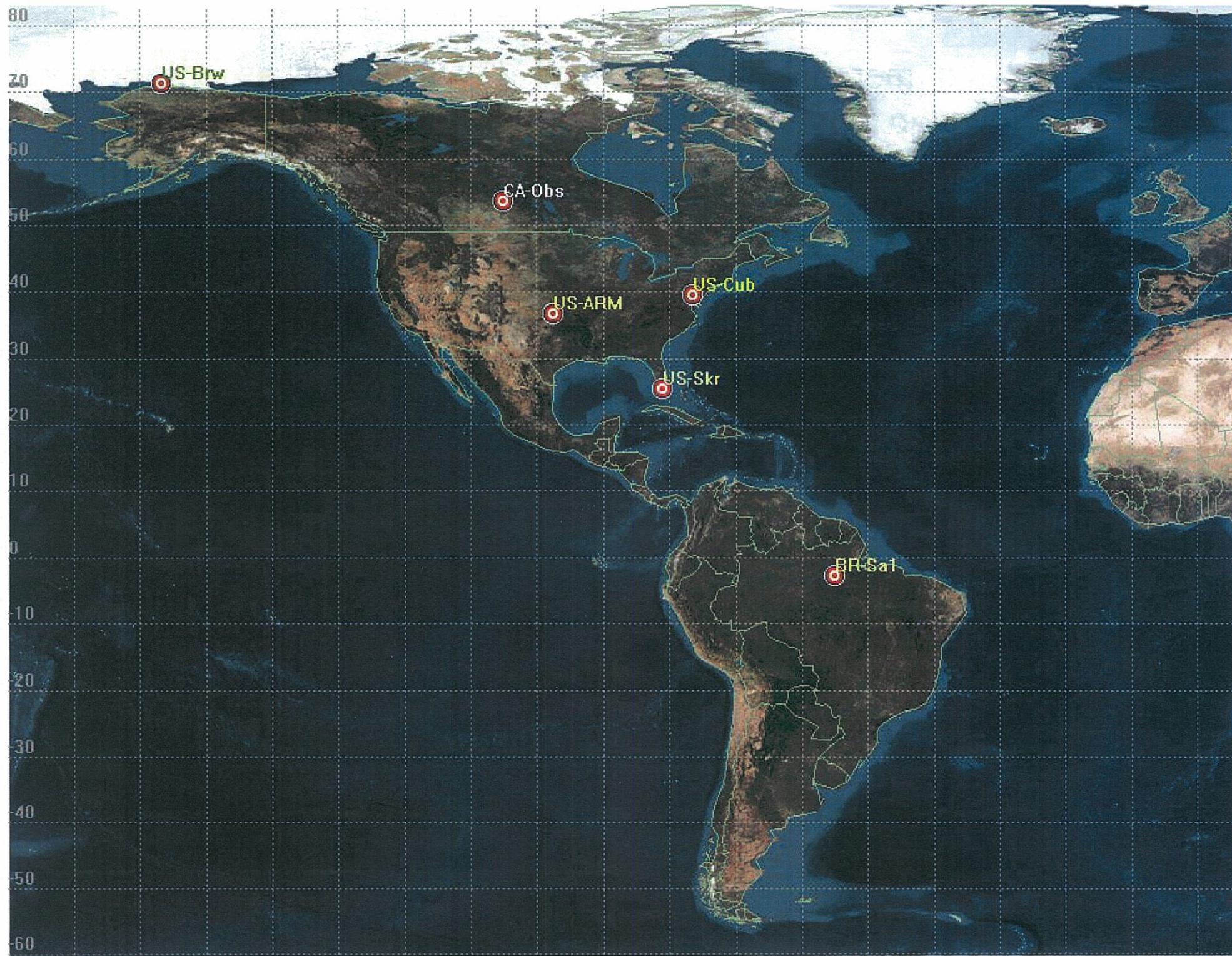


VSWIR: January 1-20, 2016

# Annual VSWIR imaging opportunities in a 19-day repeating orbit, 1 yr. simulation, with a minimum solar elevation of 20°

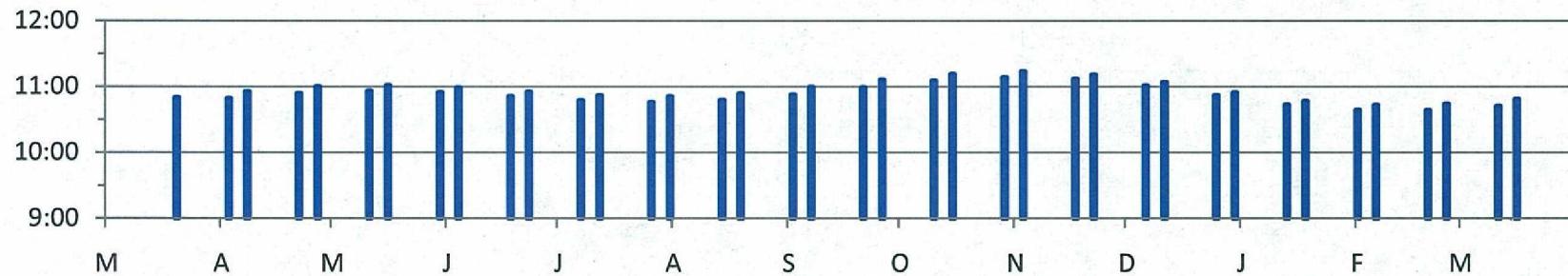


Nominal orbit: av. alt. 626.8 km, incl. 97.8°. VSWIR spectrometer FOV: 2.8° E, 10.8° W (60 m pixel GSD at nadir, 2480 cross-track pixels).  
R.G. Knox, NASA GSFC, Biospheric Sciences Branch, Code 614.4. Simulated with STK v8.1.3, March 7, 2010. Note aliasing with sample grid.

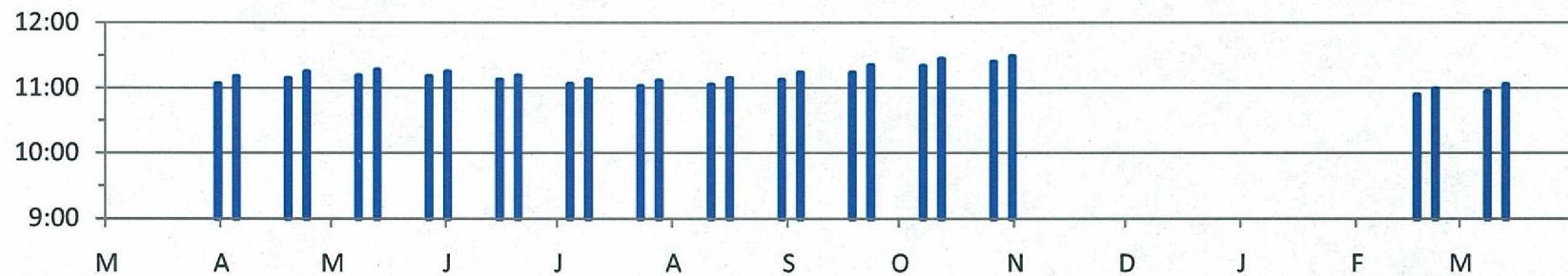


## Examples of more frequent potential VSWIR accesses (swath overlap zones, high latitudes)

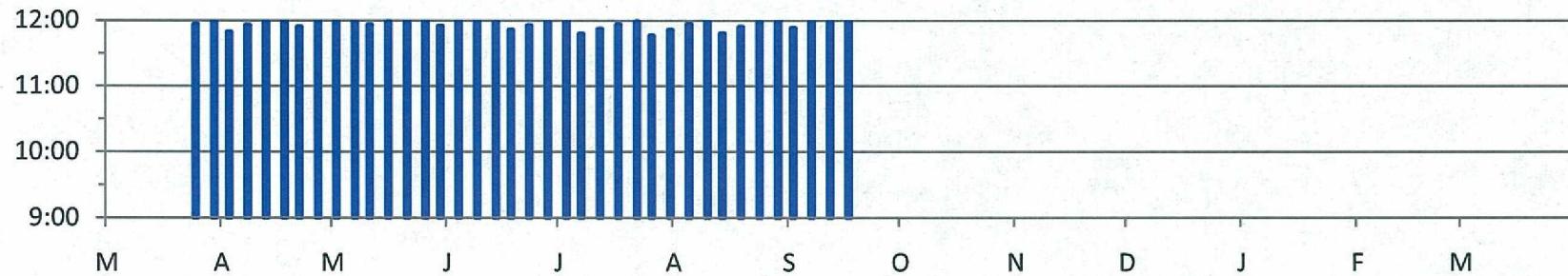
US-Cub, Baltimore LTER, Urban and Built-up, low density residential (39.41 N)



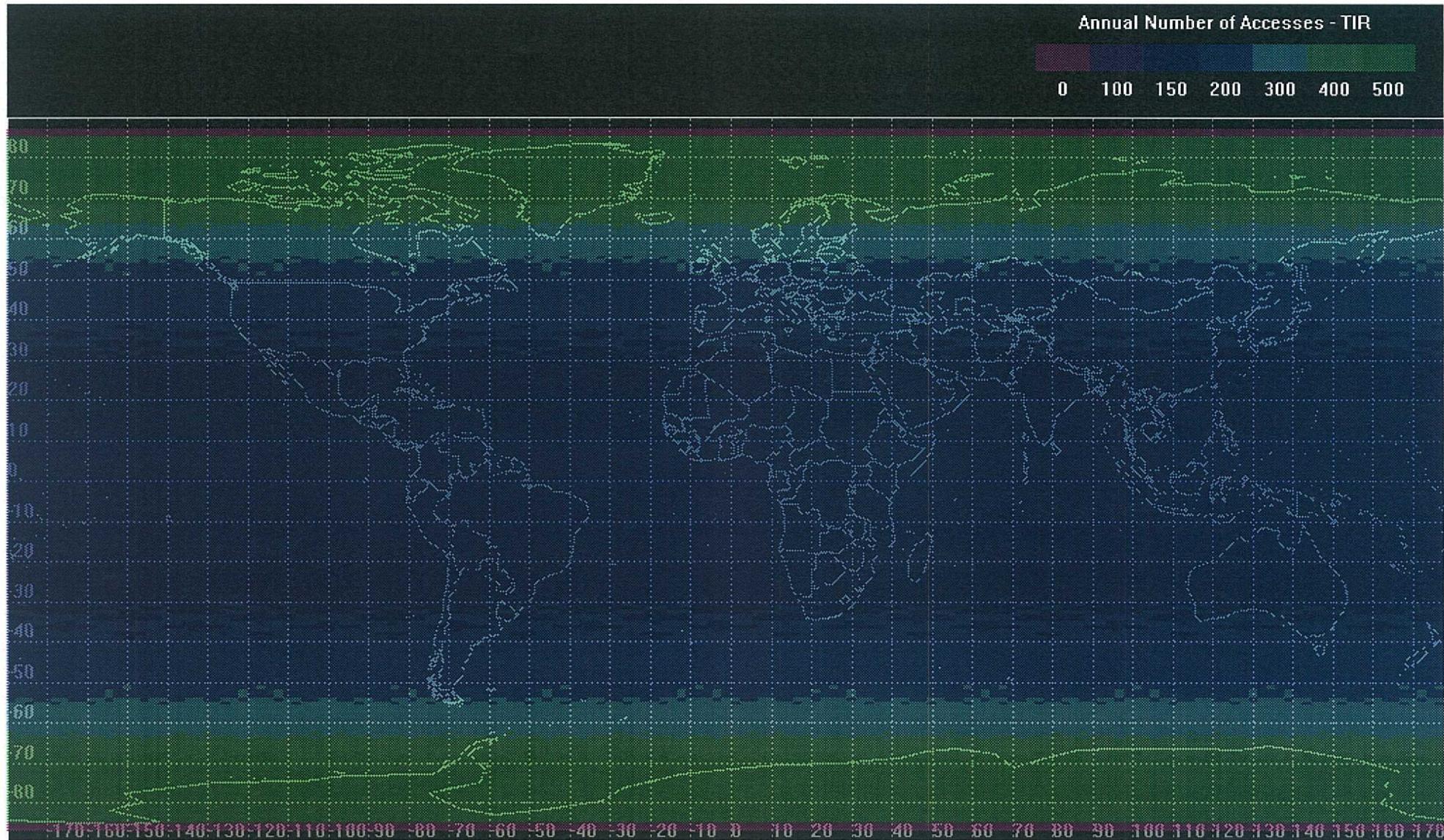
Canada - Saskatchewan - (BOREAS) SSA Old Black Spruce (53.99 N)



US - Barrow, Alaska, Moist Tundra (71.32 N)

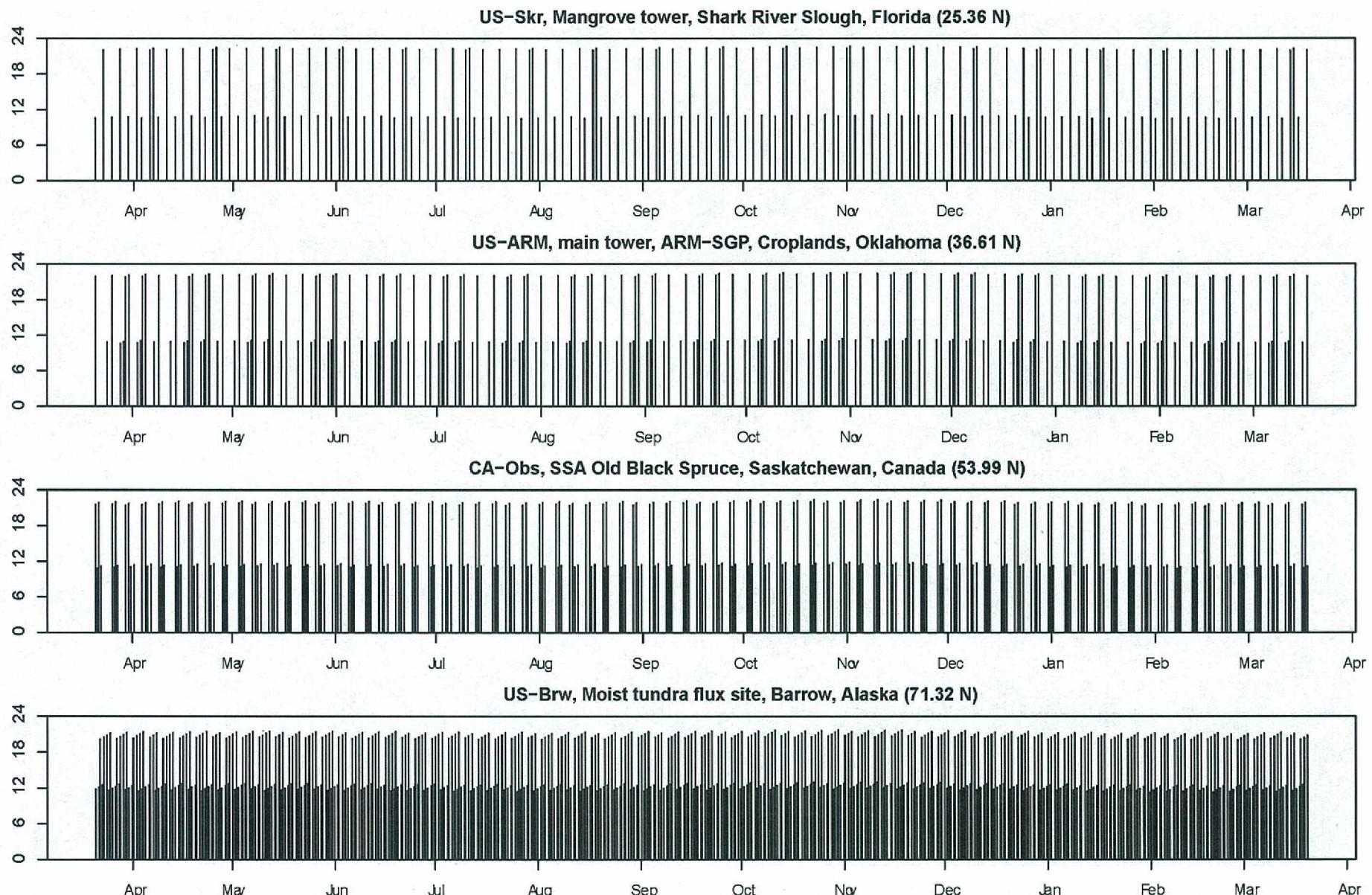


# Annual TIR imaging opportunities in a 5-day near-repeating orbit, 1 yr. simulation

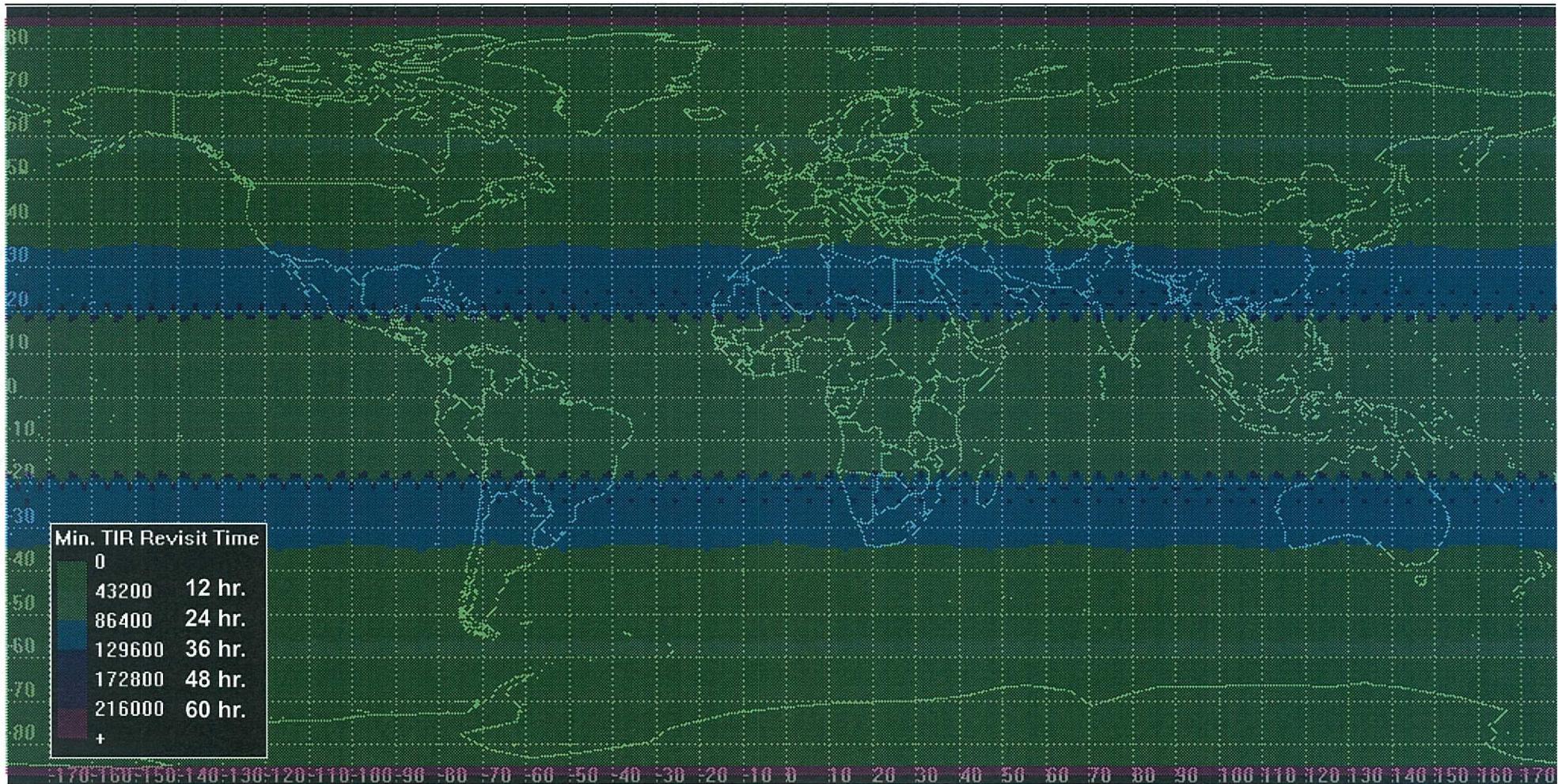


Nominal orbit: average alt. 626.8 km, inclination 97.8°. TIR imager FOV: +/- 25.46° (60 m pixel GSD at nadir, 9272 cross-track pixels).  
R.G. Knox, NASA GSFC, Biospheric Sciences Branch, Code 614.4. Simulated with STK v8.1.3, March 7, 2010. Plotted May 3, 2010.

# Frequent TIR coverage occurs at mid-latitudes and higher



Minimum times between Multispectral Thermal (TIR) Imager accesses  
Potential accesses simulated for 1 year, sampled over a 1 by 1 deg. grid



Nominal orbit: alt. 626.8 km, incl.: 97.8. TIR sensor FOV: +/- 25.46 (60 m pixel GSD at nadir, 9272 cross-track pixels).

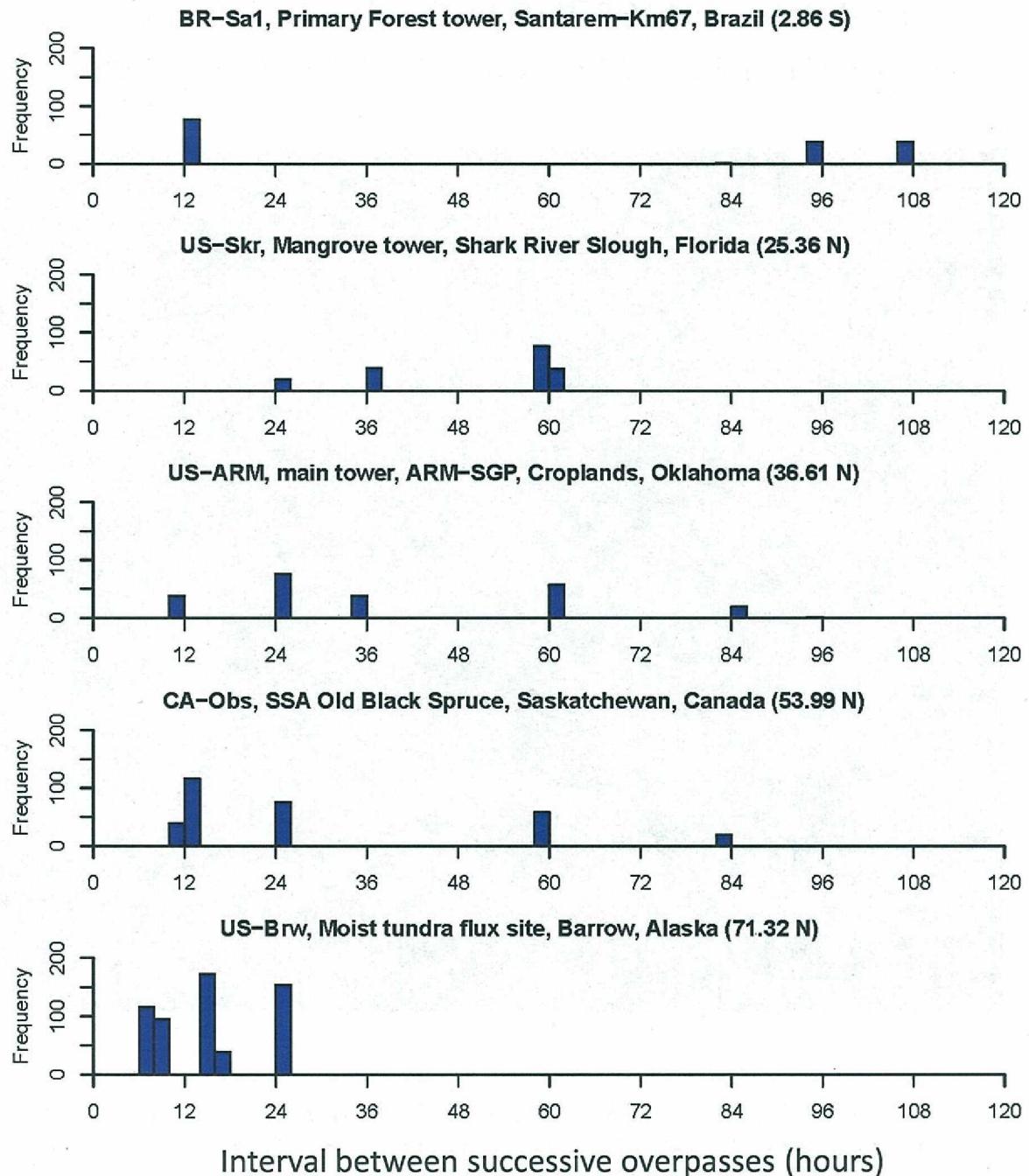
R.G. Knox, NASA GSFC, Biospheric Sciences Branch, Code 614.4. Simulated with STK v8.1.3, March 20, 2010. Plotted May 3, 2010.

## Frequency Distributions of Intervals between Potential Coverage with the TIR Instrument

Equatorial sites have frequent day-night pairs, separated by 4 days or 4.5 days.

High latitudes are characterized by revisit intervals that are daily or shorter.

A subset of subtropical locations have most overpasses separated by 2.5 days (the worst case in a 5-day repeat with both daytime and night data).



## Some conclusions & questions: Highly sampled areas

- A feasible design to meet 5-day and < 20 day requirements (the reference orbit and instrument concepts) also provides highly sampled areas: e.g., high latitudes, overlapping swaths.
- The reference orbit and TIR instrument swath provides day-night pairs—within 24 hours at many locations (was not a mission requirement).
- Questions:
  - *What science questions could best be addressed in highly sampled areas? With what level 3 or 4 data products?*
  - *Will VSWIR swath overlap zones vary over course of the mission? (orbit nodes drift away from fixed longitudes) How would that change data products?*
  - *Does the complicated pattern of time intervals between TIR re-visits, notable in some regions, present difficulties for deriving a consistent sets of products using, for example, diurnal temperature differences?*

